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An International Review of the Economic Costs of Mental Illness

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The Disease Control Priorities Project is a joint effort of The World Bank, the Fogarty International Center of the National Institutes of Health, the Bill & Melinda Gates Foundation, and the World Health Organization.

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An International Review of the Economic Costs of Mental Illness

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An International Review of the Economic Costs of Mental Illness

Executive Summary

This paper reviews published international studies on mental illness, including Alzheimer's disease and epilepsy. Reviewing the status quo on the costs of mental illness can provide further information about gaps, limitations, and future needs on this topic.

This review searched all major international journals in psychiatry, clinical psychology, health economics, and mental health policy published since 1990. Only national or aggregate cost of mental illness studies were included in the review. 38 studies were identified and reviewed in this paper -- all were individually reviewed using a conceptual framework of cost of illness methodology. Included are 11 studies on affective/anxiety/and depression, 12 on schizophrenia, 5 on overall mental illness disease, 8 on Alzheimer's disease, and 2 on epilepsy. A large majority of these cost studies were conducted in the United States, the United Kingdom, and Australia. Cost of illness studies are lacking from Africa, Asia, Eastern Europe, and Latin America.

The studies reviewed indicate great variation in cost estimates even for the same mental disorder during the same time period within a country. These wide variations may be due to differences in disorder classification, definition of cost categories, sample population, data sources, discounting rate, and other factors. An additional problem is international comparability -- different health care financing systems, delivery systems, and conversion into U.S. dollar values.

However, results of cost of illness can be compared within its own study. Empirical results from the reviewed studies indicate that the negative economic consequences of mental illness far exceed the direct cost of treatment, thus making it important to treat mental illness. Currently, the direct treatment cost for each individual mental disorder is between 1% and 2% of total national health care costs. Overall, mental illness accounted for about 7% of total health care expenditures in the U.S. and 1.8% in Australia.

Given the limitations of the cost of illness studies reviewed, one should be careful in interpreting and using these estimated results, recognizing the limitations and omissions of each study. Nonetheless, these studies can be useful for understanding the magnitude of treating an illness or the economic consequences of an illness for purposes of planning or budgeting. Thus, additional cost of mental illness studies with appropriate methodology are needed in Africa, Asia, Eastern Europe, and Latin America. Such studies are one way to inform policymakers in those regions about the economic consequences of mental illness. There are guidelines and standards for estimating cost of illness and reporting cost of illness studies for future researchers to follow.

An International Review of the Economic Costs of Mental Illness

I. Introduction

Mental illness is a major disorder that can lead to both physical and emotional disability. Policymakers need to know not only the epidemiological indicators of mental illness, such as prevalence rate and incidence rate, but also the size of its negative impact on the economy. The first study to address the issue of mental illness and the economic value of a man dates back more than fifty years (Malzberg, 1950). A second study published more than forty years ago provided a systematic cost analysis of the economics of mental illness (Fein, 1958). Since then, dozens of studies have looked at the economic costs of mental illness. These studies have come primarily from US and UK researchers, a few from Europe or Australia, and very few from the rest of the world.

Economic cost of illness studies describe the economic burden of a disease to the society. Thus, cost of illness information should be useful for government agencies, pharmaceutical industries, medical professionals, and insurance payers to know (1) the quantity of resources (in monetary terms) used to treat a disease, and (2) the size of the negative economic consequences (in terms of lost productivity) of illness to the society. To achieve these two objectives, cost of illness studies need to provide national or macro cost estimates. An additional function of these studies is to compare the outcomes of a treatment so that cost and effectiveness comparisons can be made. To carry out cost-effectiveness comparisons of a particular treatment or intervention requires population-

specific cost analysis and often with controlled pre/post comparison. These cost-effectiveness comparisons are not part of the scope of this review.

This paper reviews the status of empirical estimates of the economic costs of mental illness among all recent international studies. Through this review, we hope to clarify the gaps that exist on cost information, the limitations in the cost literature, the conditions under which cost of illness results can be useful, and the need for future research by the international community on the economic costs of mental illness.

Some cost of illness studies are initiated by intellectual curiosity. Professionals wish to estimate the economic magnitude of an illness to inform the profession or society (Malzberg, 1950; Fein, 1958). Many cost of illness studies are supported by government agencies wishing to inform policymakers and help justify the need for additional budget allocations (Rice, 1996; Varmus, 1999), while some cost of illness studies are supported by the pharmaceutical industry to justify their investment in product development, marketing, and pricing (Greenberg, 1993-1996. Davies and Drummond, 1994). Some reviews of cost of illness studies focus on entire disease categories (Hu and Sandifer, 1982; Jarvinen, Rice, Kelman, 1988; Bloom et al., 2001), while others look at specific disease categories, such as depression (Berto et al., 2000) or schizophrenia (Tediosi et al., 2000). To better understand the current cost of mental illness, this review focuses on studies published since 1990.

II. Cost of Illness Methodology

Before reviewing the cost literature, it is useful to review the estimation methodology.

Definition of Mental Illness

It is important to clearly define the disease using an international disease code, such as ICD-9M, ICD-10M, DSM-III, or DSM-IV before carrying out a cost of illness study. In reality, however, the definition of mental illness is not always clear cut, either because researchers lack clear recognition of these disease codes or because different cultural and health care systems classify mental illness differently. Obvious examples are the classification of senile dementia (Alzheimer's) and epilepsy. In the U.S., these disorders are not under the research jurisdiction of the National Institute of Mental Health (NIMH). In Europe, however, these two illnesses are considered a part of mental illness because they are neurological disorders.

Definition of Costs

The cost of an illness is the economic burden of that disease to society. The economic burden of a disease implies the total value of resources used or lost as a result of a particular illness, such as mental illness. Psychological costs are important, but they have not often been monetized. The treatment of mental illness and its effects involve not only the private sector, but also the public sector. Thus, cost estimates can be examined from society's point of view. These illnesses affect the government's health care expenditures, which is one part of the cost to society. This review focuses on societal costs only. Individual cost/effectiveness studies are not included in this review.

The cost of illness can be divided into direct costs and indirect costs. Direct costs are the value of resources used in the treatment of disease. They include costs for

outpatients, emergency/crisis centers, inpatients, medications, community services, etc. These estimates are used to address the question of the quantity of resources used to treat a disease. Indirect costs are the value of resources lost as a result of illness. They include productivity loss due to either morbidity or mortality. These estimates are used to address the question of the magnitude of the negative economic consequences of illness to the society. Indirect costs are often estimated using a human capital approach. However, a willingness to pay method also has been used. The human capital approach estimates costs from discounted forgone earnings, while the willingness to pay method estimates costs based on individuals' perception of the amount of money they would be willing to give up to avoid illness. The majority of studies use the human capital approach, since data are often readily available and relatively easy to estimate.

Both the human capital approach and the willingness to pay approach have shortcomings. The human capital approach may be particularly biased towards the young, females, ethnic minorities, and the elderly. The willingness to pay approach is largely influenced by the income of respondents. Neither of these two methods can provide the true value of resources lost. The World Health Organization (WHO) has developed Global Burden of Disease (GBD) estimates based on disability adjusted life years (DALY), (Murray and Lopez, 1997). WHO already has provided a comprehensive summary by global regions. This review will not duplicate the results of DALY, but will focus only on the economic costs of mental illness expressed in monetary value.

Methods of Estimation

Cost studies use one of two approaches to estimate cost of illness: (1) a prevalence-based approach, and (2) an incidence-based approach. A prevalence-based

cost study estimates the cost burden to society during a given time period, such as a given year. The incidence-based cost study estimates the cost of an illness from the time of first diagnosis until recovery or death, which is a lifetime cost estimate. Obviously, the incidence-based cost study requires much more information. As a result, most studies use a prevalence-based approach.

Estimating the resources consumed by an illness can be done by one of two methods depending on the type of data available. The “top-down” method relies on available aggregate or national figures of health services utilization or morbidity/mortality information by identifying particular disease codes (DSM-III, DSM-IV, or ICD-9-CM, ICD-10-CM). The “bottom-up” method examines the records of a sample of patients or follows a sample of patients’ health services to estimate and project the national cost of illness. Thus, the bottom-up method requires a representative sample. Both methods have been used in the literature.

Monetary Value

This paper reviews international cost of illness studies. In addition to reporting the estimates in local currency, for comparison purposes, the monetary figures also are converted into U.S. dollars based on the available exchange rate of the closest study year (reference year). Most of the studies’ cost data were obtained in the early 1990s. Obviously, exchange rates are influenced by international trade and foreign exchange markets. These cost figures converted to U.S. dollars may not always truly reflect the value of the domestic currency.

An alternative way to examine the impact of illness at the national review level is to compare direct costs of illness to total national medical expenditures and to compare

the total cost of illness (including indirect-cost-productivity loss) to domestic national product.

Sensitivity Analysis

Each cost of illness study contains a number of assumptions, such as prevalence rate, labor force participation rate, mortality rate, wages, discount rate, and so on.

Engaging in a sensitivity analysis to test the robustness of cost estimates is desirable.

A framework for reviewing cost of illness studies was developed according to the above-described cost methodology so that an international summary can be provided.

III. Data Sources

An extensive computer literature search was conducted for any publication since 1990 by reading Medline databases, Google website, Meryle databases, Embase databases, and supplemented by a special review of major international psychiatric journals as well as a special search for websites of established health economists. In addition, non-English publications were sought, and publications also were obtained through personal contact. Appendix A provides a list of references reviewed by this paper.

Studies reviewed had to satisfy the following criteria:

- (i) a defined national population,
- (ii) published since January 1990,
- (iii) a defined diagnosis, e.g., mental illness, schizophrenia, depression/affective disorder, anxiety, or other unspecific psychotic

disorders (preferably identified by ICD-9, ICD-10, or DSM-III, DSM-IV),
Alzheimer, epilepsy, and

- (iv) monetary estimates for either direct costs or indirect costs, or both.

Our extensive search identified only 38 studies on mental illness for review. In addition, cost review papers, cost methodology papers, and related commentary were as references for this review.

Not all the studies reviewed are based on national statistics or national surveys; some are small-scale individual surveys while others are from authors' estimates. Not all studies are published in refereed professional journals; some appeared in non-refereed publications at conferences or are institutional reports. This review is based on publications appearing in national/international refereed journals.

IV. Results

A systematic review framework was developed based on the studies' cost methodology. Table 1 provides a summary of 38 cost studies reviewed by country/region and by mental illness categories. As noted, most cost of illness studies have been conducted in the U.S. and the U.K.. Several other individual studies were carried out in Australia, China (Taipei), France, Hungary, Italy, and Kenya. The paucity of mental health cost studies from lower/middle income countries reflects either a lack of recognition of mental illness in the society, lack of funding, lack of data, or lack of professional training in how to conduct cost of illness studies. A recent survey conducted by WHO (Saxena et al., 2003) provides empirical evidence of these deficiencies.

In terms of mental illness subcategories, affective disorder/depression (11 studies) and schizophrenia (12 studies) have the largest share of studies, followed by Alzheimer's disease (8 studies). For international comparison purposes, we will summarize these individual cost studies by disease categories: (1) affective disorder/anxiety/depression, (2) schizophrenia, (3) overall mental disorders, (4) Alzheimer's disease (senile dementia), and (5) epilepsy. Each will be discussed separately.

1. Affective Disorder/Anxiety/Depression

Table 2 provides a summary of 11 studies of the cost of affective disorder/anxiety/depression (including one bipolar disorder), but conducted in only four countries (Australia, China (Taipei), U.K., and U.S.). These studies, except the Taipei (China) study, used the top-down approach (national aggregate statistics) to allocate the costs of affective disorder/depression. The Jonsson and Bebbington (1994) UK study estimated only the direct cost by using the unit cost of treating depression multiplied by the number of depression episodes. No indirect costs are provided. The authors acknowledged that their cost estimates, U.S. \$354 million, are underestimated, compared to the Kind and Sorensen UK (1993) study, which estimated direct costs of U.S. \$665 million. In the Kind and Sorensen (1993) study, direct costs represent only about 12% of total costs. Their indirect costs include the lost working days from the average length of the depression episode and average number of depression episodes.

The Rice and Miller (1995) study estimated the cost of affective disorder in 1990 at \$19,210 million in direct costs and \$9,858 million in indirect costs (direct costs equal 63% of total costs). Greenberg et al. (1996) estimated the direct costs of depression at \$12,400 million with indirect costs of \$31,300 million (direct costs equal only 28% of

total costs). The major differences in these two studies result from: (1) different data sources (the former used national health services utilization statistics, while the latter used epidemiological survey data), and (2) different methods of estimating morbidity costs. Rice and Miller (1995) estimated productivity losses based on regression analysis that measured the life time effect on current income of individuals with depression, taking into account the timing of onset and duration of this disorder. On the other hand, Greenberg et al. (1993) used the average differences between individuals with or without depression disorder. The total cost difference between these two studies is \$13,300 million, with Greenberg et al.'s (1993) estimate about 40% higher than Rice and Miller's (1995) estimates.

The Taipei (China) study, by Yeh et al. (1999) is a bottom-up study using data on individuals diagnosed with depression. The authors first estimated the cost per depression patient and then multiplied that cost by the number of patients who sought treatment for depression to estimate the direct costs of \$353 million. They then used the human capital approach to estimate the loss of productivity due to depression at \$1,053 million. The result is direct costs of depression of \$1,406 million, 25% of total costs.

In general, the indirect costs of depression are much higher than direct costs, due largely to the economic cost of mortality (i.e., suicide due to depression). Given the variations in cost estimates even within a single country and within the same year, it is very important to compare the various assumptions concerning prevalence, duration, treatment, data sources, and discount rates when comparing these cost estimates.

Three Australian studies are available on the cost of affective disorder and depression. However, each estimated only indirect costs (Lim et al., 2000) or direct costs (Andrew et al., 2000 and Sanderson, 2003), not total costs.

Direct costs relate to actual treatment expenditures; thus, it would be useful to compare these expenditures with total national health care expenditures. It can be seen from Table 2 that the direct costs of affective disorder/anxiety/depression represent between 0.5% (UK) or 0.9% (UK) and 2.3% (Taipei, China) of total health care expenditures.

2. Schizophrenia

Ten countries have studied the cost of schizophrenia, many more than have studied other mental illness categories, as shown in Table 3. Obviously, schizophrenia has more serious health and cost consequences and often requires more institutional care or intensive care than depression. Studies in France (Rouillon et al., 1997) and the Netherlands (Evers and Ament, 1995) provide very detailed data on the direct cost of treating schizophrenia, but no attempts were made to estimate indirect costs.

One of two studies from the UK study used the incidence approach (Davies and Drummond, 1994), while the other (Knapp, 1999) used the prevalence approach. The direct cost estimates provided by Davies and Drummond exclude costs incurred outside the UK National Health Services; thus, their estimated direct cost is about 30% of Knapp's cost estimate. On the other hand, Knapp has lower indirect costs, which do not completely include the mortality costs. The proportion of direct costs to total costs for these two studies is 20% for the Davies and Drummond study and 54% for the Knapp study. Again, two different studies show an overall cost difference of 20%.

Among the schizophrenia cost studies, the U.S. incurred the highest costs -- \$17,296 million in direct costs, \$11,996 million in indirect costs, and other related cost (social services and criminal system, \$3,208 million not included in the table), for a total cost of \$32,500 million (Rice et al., 1998).

Only one of the 12 studies of the costs of schizophrenia was from an Eastern European country (Hungary, Rupp et al., 1999). The authors obtained utilization data from national surveys and the Central Statistical Bureau and cost information from interviews with financial officers in different treatment settings. The total cost converted into US dollars was \$41.1 million in 1990. Following the Rice et al. (1998) human capital approach, the total indirect costs were US \$68.5 million for total costs of US \$109.6 million.

In general, direct costs are more reliable since these costs are estimated from treatment costs, obtained by type of health care services, amount of services, and cost per unit of services. However, the very wide variation in these direct cost estimates (converted into US\$), ranging from \$8.3 million in Italy to \$432 million in the Netherlands to \$2,340 million in France, indicates that these estimates are not comparable. It is not possible to have variations of more than 100 times between these European countries, given the limited variation in the size of their population. The variations are due to their cost estimation methodology and data sources on prevalence rate, services utilization, and unit cost of services.

The estimated indirect costs for schizophrenia vary even more widely than the direct costs. For instance, the Canadian study (Goeree et al., 1999) used two different methods: a human capital approach and friction costs approach (job replacement cost)

and found almost a 7-fold difference in costs. This example shows the overestimation of indirect costs than can result from using a human capital approach.

Most of these studies indicate that the indirect costs of schizophrenia are higher than their direct costs. The Norway study (Rund and Ruud, 1999) and the UK study (Knapp, 1999) do not include mortality costs.

When the direct costs of schizophrenia are compared to total national health care expenditures, the proportion ranges between 1% and 2%, except for the data from Italy (Tarricone et al., 2000) and Taipei/China (Yeh, 1999). These magnitudes are quite comparable to the direct costs of depression.

Depression is much less prevalent than schizophrenia. On the other hand, the cost of treatment for depression is much lower than treating schizophrenia. Reviewing the components of treatment costs, depression patients receive more outpatient services, while schizophrenia patients have higher inpatient costs.

When comparing the direct cost of treating schizophrenia to total national health care expenditures, the range is from 0.08% in Taipei (China) to 2% in France and Norway. Most estimates are close to 2%.

3. Overall Mental Disorders

Very few studies estimate the cost of overall mental disorders, since that estimate requires more comprehensive data sources and disorder identification. Only three studies -- Australia (Carr et al., 2003), Taipei/China (Yeh et al., 1999), and U.S. (Rice and Miller, 1998) -- provided overall costs of mental illness as shown in Table 4. The US study is the most comprehensive and uses national aggregate statistics (top-down

method), while the other two use individual sample statistics (bottom-up method) to project the national figures.

The US study indicates that 7% of total health care expenditures are spent on mental illness and that the total cost of mental disorders is about 2% of U.S. GDP. The Taipei/China study indicates a lower figure, 3.2% of health care expenditures for mental illness services, while Australia estimates about 1.8% of total health care expenditures are spent on mental disorders.

The only African country study on cost of mental illness is from Kenya (Kirigia and Sambo, 2003). This study provided a very detailed cost estimation framework using a human capital approach with discounting procedures to obtain present values of indirect costs. Unfortunately, the study does not provide specific mental disorder categories. Given the 1998/99 exchange rate between the US and Kenyan currency, the total costs of the mental disorders in Kenya was U.S. \$205,347.

4. Alzheimer's Disease (Senile Dementia)

As the world population increases its life expectancy, more elderly people suffer from Alzheimer's disease (AD). Financing the cost of AD becomes an increasing burden to patients' families as well as to society. Quite a number of studies have looked at the economic cost of AD, two each from the U.K. and the U.S., and others are from Belgium, Canada, Israel, and Italy.

One of the special features of Alzheimer's disease is that patients, especially those residing in communities, need extensive care services. Alzheimer's disease is also one of the key causes of nursing home admission. Because of the nature of the illness, informal care costs (care not obtained from the service market and not financially reimbursed) by

family members, friends, or some charitable agencies is one feature of the cost component. Since these costs are not reimbursed by a market mechanism, researchers use a replacement cost approach (the value of services that could be provided by the service market). In addition, there are clinical challenges to identifying patients with Alzheimer's disease. National epidemiology and incidence of Alzheimer's disease is difficult to obtain. Therefore, most studies rely on individual surveys and carry out prospective cost data collection, so that 7 of 8 studies estimated cost of care per patient without projecting national costs. Only a UK study (Gray and Fenn, 1993) estimated total national costs of AD in England.

Given the wide cost variations in care settings (community vs. institution) and degree of severity (mild, moderate, and severe), some studies estimated cost per patient by setting, while others estimated cost by severity. For instance, in Belgium, total patient costs at home were valued at US \$553, while cost per patient at hospital/institution was valued at US \$2,856 (Scuvee-Morreau et al., 2002). On the other hand, per patient costs in Israel were estimated at \$17,730 for community living and \$16,995 for institutional living (Schnaider et al., 2002). About 60% of the community patient care costs represented informal care costs. Cost of informal care in these studies include family members' personal daily living care (i.e., feeding, bathing, toileting, walking). The authors acknowledge possible overestimation of the costs of informal care, based on a replacement cost approach.

Two US studies reviewed (Rice et al., 1993; Ernst and Hay, 1994) both estimated cost per patient, but did not project a national cost estimate. It is interesting to note that while total cost of care for Alzheimer patients in 1990 for either a community or

institutional setting is quite close (\$47,083 and \$47,581, respectively), the majority of community care costs are from informal care (using a replacement cost approach) while institutional care costs are mainly from formal care. These average costs are estimated from 93 patients in the community and 94 patients in a nursing home.

The Ernst and Hay study used national survey data and published studies to estimate cost per Alzheimer patient. Unlike Rice et al. (1993), Ernst and Hay estimated the costs of Alzheimer's from the beginning of diagnosis to completely disabled, assuming a survival of 3.3 years for men and 4.5 years for women. A discounting rate of 3% was applied to direct annual costs. Their direct costs (Ernst and Hay, 1994) of treating Alzheimer patients is almost as much as the total cost estimated by Rice et al. (1993). However, when adding estimated indirect (premature mortality costs) and unpaid caregiver costs, Ernst and Hay study (1994) has \$123,556, almost two and a half times the direct cost. Again, these two examples indicate that the results are not comparable because data sources, cost category, and time frame (prevalence versus incidence) can provide completely different estimates.

Two cost-per-patient studies were estimated by condition of severity. The Canadian studies estimated costs according to mild, mild to moderate, moderate, and severe, with costs ranging from US \$7,124 per year to US \$27,734 per year (Hux et al., 1998), while the England study provided cost per patient ranging from US \$11,693 for mild conditions to US \$24,023 for severe conditions (Souetre et al., 1999). The only national cost estimate was conducted for the U.K.. The direct cost of AD was US \$1.7 billion.

Most AD cost studies focus on direct cost. The cost of care for community AD patients is largely born by caregivers (informal care), while institutional care for AD patients is largely incurred at nursing institutions. The overall conclusion is that cost estimates suggest that the caring for the patient would be lower at home rather than in an institution, even if the cost of unpaid care is valued. This estimated cost information is useful for financing agencies and professional organizations in planning resources for care of AD patients.

5. Epilepsy

Epilepsy is considered a disease of the central nervous system. Its prevalence or incidence rate is much smaller than traditional mental illness (depression, schizophrenia, etc.). Only two cost studies were available for review. The UK study (Jacoby et al., 1998), used a sample of 785 epilepsy patients from general practice to obtain their direct costs (hospital care, community health, and community-based non-health services, together with national data sources). 58% of total annual costs represented inpatient costs, followed by 23% for drug costs. The estimated total direct cost was US \$1.96 billion in 1993, about 60% related to non-health costs. This study did not estimate the costs of underemployment or unemployment, but suggests that epilepsy represents 2.5% of total health care expenditures in U.K..

The US study (Murray et al., 1996) provided the cost of epilepsy from a panel of medical experts who used both prevalence rate and incidence rate. Medical experts provided information about required services utilization (inpatient, outpatient, testing, medication, and frequency of usage) while unit costs of services were obtained from government reimbursement records (Medicare and Medicaid payment systems). The

total direct costs from prevalence data were \$912.5 million for 335,167 individuals during 1994, while the first year direct incidence costs were \$101.2 million for 24,578 cases. Indirect costs were obtained from the Department of Commerce data (earnings loss due to physical and psychological effects of the disease and cost for a caretaker). The indirect costs using prevalence data were \$2,993 million while the one-year incidence costs were \$217.4 million. The total costs were \$3,905 million based on prevalence rate and \$319 million using first-year incidence rates. Direct medical costs account for one-third of the total costs, while indirect costs constitute the remaining two-thirds.

V. Discussion

This review of published international studies on the economic costs of mental illness evaluates the potential usefulness of the results in decision making and points out gaps/limitations for future studies on the costs of mental illness. From this review, we have learned the following:

1. The large majority of cost of mental illness studies have been carried out in high income countries, especially in the U.S., U.K., and Western Europe. High income countries have greater recognition of mental illnesses, and they allocate more resources to research and treatment of mental illness (Saxena et al., 2003). Therefore, researchers in low/middle income countries should be encouraged to engage in mental health cost analysis to make policymakers aware of the economic consequences of mental illness to the society (Hu, 2003).

2. The review has illustrated two methods of estimating direct costs: top-down method and bottom-up method. In general, the top-down method relies on national aggregate data or survey data; thus, these studies tend to be representative of national populations. The national survey data provide not only prevalence rates but also access rates, thus resulting in more reliable data from the top-down method. IN recent years more large national survey data are available, and studies in the US and Australia have taken advantage of these data sets. The bottom-up method uses smaller available sample or case studies, not always representative of entire populations. Even with detailed accurate costs per patient, this method still requires data to project national aggregate costs. Researchers should be encouraged to seek national survey data to conduct cost analyses. However, in the absence of national survey data and with a limited research budget, the bottom-up method is still an alternative way to estimate costs of illness. It at least provides useful information on the cost of treatment per mental illness patient.

3. Methods of estimating cost of illness have evolved significantly over the past ten years. The central question is how much economic cost is really attributable to a specific illness, such as mental illness. In the past decade, with the availability of large national epidemiological surveys and health services utilization surveys, the application of econometric modeling is a relatively recent development that began in the mid-1990s. The traditional approach before the mid-1990s involved the usage of results of surveys by identifying disease code and then multiplying units of services with cost per unit of service for direct costs or by establishing attributable factors of illness on morbidity/mortality to estimate loss earnings. The studies by Rice and Miller (1995), Greenberg et al. (1999), and Lim et al. (2000) used the Multivariate regression model to

estimate service usage costs and workplace costs of depression, attributable to depression. Methods used by these studies are good examples for future estimation of economic costs of illness.

4. There are varying degrees of comprehensiveness and methodologically sound papers versus less complete cost studies. A sound and convincing cost study should include all aspects of cost categories discussed in the methodology section II. The majority of these reviewed studies used a prevalence-based approach. Several comprehensive studies that closely followed these methodologies are Knapp and Sorenson (1993), Rice and Miller (1998), and Greenberg et al. (1999). This review only found one study that used an incidence-based approach, given the difficulty to estimate lifetime cost of the disease, Davis and Drummond (1994).

5. The studies reviewed indicate great variations in cost estimates even for the same mental disorder during the same time period within a country. A much broader review of US cost of illness studies (Bloom et al., 2001) concluded that the wide variations in cost estimates for the same diagnosis raise serious questions about the comparability, accuracy, and validity of all studies. The variability among estimates of studies may be due to (1) deficiencies in clear disorder definitions, (2) definitions of cost categories, (3) populations or sample studied, (4) sources of costs and services utilization, (5) analytical framework, including the use of the human capital approach, and (6) incomplete cost categories due to unavailability of data.

If cost studies of the same illness within a country are not comparable, then obviously these studies would not be comparable for the same illness across other countries. Additional reasons for international incomparability include (1) different

health care financing systems, (2) different health care delivery systems, and (3) the arbitrariness of converting local currency to U.S. dollar values.

6. If cost of mental illness studies are not comparable within a country and cannot be comparable between countries, then under what conditions would these cost estimates still be useful?

First, users of cost studies should be aware of the differences in estimating cost of illness, either due to definition of illness, cost categories, data sources, and assumptions. To be comparable, these differences should be adjusted or acknowledged. In other words, as long as users are aware of these limitations, results can still be useful for understanding the magnitude of treating an illness or the economic consequences of an illness, if not necessarily for priority setting or program evaluation.

Second, while cost studies per se are not comparable internationally, estimated direct costs can be compared to total national health care expenditures within a country. Thus, the magnitude of the economic consequences of an illness to the society can be quantified.

Third, when examining estimates of direct costs and indirect costs, recognize that estimation of direct costs is much more straightforward than indirect costs. Thus, at least direct costs can provide information on how much health care services resources have been expended for a given illness. While this information may not be used for cost-effectiveness or program evaluation, it can be used for budgeting or health care finance planning.

7. Empirical results of the reviewed studies indicate that the direct costs of mental illness are much less than the indirect costs for affective/anxiety/depression,

schizophrenia, overall mental illness, and epilepsy. In other words, the negative economic consequences of mental illness greatly exceeds the costs of treatment. Thus, it is important to treat mental illness.

8. Comparing direct treatment costs to total national health care expenditures, most mental illness categories (depression, affective disorder, or schizophrenia) took up between 1% and 2% of total health care costs. Overall mental illness contributed to about 7% of total health care expenditures in the U.S., 3.2% in Taipei (China), and 1.8% in Australia.

VI. Concluding Remarks and Recommendations

Most cost of illness studies reviewed were supported by either the government or the pharmaceutical industry. The government uses this information to argue for more resources for a particular illness. The pharmaceutical industry uses this information to justify its research and development of a particular product or to show the economic consequences of letting a disease take its course, i.e., the magnitude of the indirect costs of the illness.

Given the limitations cited above, why do the government and pharmaceutical industry continue to support cost of illness studies? Why do many clinical studies continue to cite a numerical estimate of the cost of illness in the introduction to their papers? The answer is that government policymakers and clinicians desire to know the importance of the economic impact and consequences of an illness beyond the epidemiological focus of a morbidity or mortality rate. After all, before one allocates resources for treatment, one needs to know the costs of treating this illness from society's

point of view and the economic consequences of not treating the disease. These are legitimate and logical concerns. A review survey by WHO (Saxena et al., 2003) on government budget allocations to mental health services found only limited allocations, less than one percent of the government budget, for mental illness. To make government policymakers aware of the seriousness of mental illness, a careful estimation of the cost of mental illness is needed to justify additional resources (Hu, 2003). On the other hand, cost studies should be carried out with appropriate methodology and reliable data sources. Otherwise, policymakers may be misled for resource allocation. An article titled “Cost-of-Illness Studies: A Major Headache?” (Drummond, 1992) reminded readers that cost of illness studies would present a headache to policymakers if not used appropriately. In allocating resources, one should not only evaluate the cost of illness but also the outcomes or benefits of intervention for the disease in question.

Quite a few review studies on the cost of illness have suggested that most cost of illness studies may not be able to provide meaningful information in priority setting or program evaluation (Drummond, 1992; Maynard, 1997; and Bloom et al., 2001). While these authors all make valid points, perhaps they expected too much from cost of illness studies. Cost of illness is one indicator of the consequences of an illness, expressed in monetary value. It cannot serve for program evaluation or priority setting. It can be used for resource planning and financial planning if costs are estimated appropriately. As indicated in the U.S. Institute of Medicine report (1998), “In setting priorities National Institute should strengthen the analysis and use of health data, such as burdens and costs of diseases, and of data on impact of research on the health of the public” (p.5).

Given this review, what type of information might be useful for the government, pharmaceutical industry, or international health care community? What advice should be given to users of these studies? If users are interested in the monetary consequences of illness and are carefully informed about the methodology and limitation of a particular cost of illness study, then the estimated economic cost of illness can still be used as a point of reference for justifying an intervention or policy decision. In other words, if users are confident that the results are reasonably accurate, they may use this information for policy arguments. Within cost of illness studies in general estimated direct costs are relatively more accurate than indirect costs since direct cost (treatment) data require fewer assumptions and are more accessible for deriving cost estimates. Therefore, direct costs are more reliable than indirect costs. In reporting cost of illness, it would be important to separate direct costs from indirect costs. If one needs to compare cost studies, comparing direct costs between studies is less risky than comparing total costs. Users also can analyze the cost components of outpatient, inpatient, and other social services within direct costs, in considering cost implications and future service delivery implementation.

A large majority of the reviewed studies were conducted in the U.S., U.K., with some others from Australia and European countries. There is a lack of cost of illness studies from Asia, Latin America, Eastern Europe, and Africa, areas/countries that devote the lowest percentage of their budget to treating mental disorders. Given the limitations of cost of illness studies and the incomparability among international studies, should we still encourage these countries to conduct studies on the cost of mental disorders? The answer is still a yes. Cost of illness studies can still be viable and provide useful

information if these studies are based on sound methodology and use appropriate data sources. Even if a study is not useful for international comparison, cost estimates can be used within a country to inform its domestic policymakers. If cost of illness studies are carried out appropriately, they can still be useful in promoting an international mental health policy dialogue and can address the issue of financial planning, by comparing the relative magnitude of the cost of an illness to the country's own respective national total health care expenditures and gross national product. Cost of illness estimates can be used to inform concerning the economic status quo of an illness. Toward this end, additional cost of mental illness studies with appropriate methodology are needed in Africa, Asia, Eastern Europe, and Latin America. Such studies are one way to inform policymakers in those regions about the economic consequences of mental illness. The importance of knowing the costs of mental illness would facilitate effective utilization of the scarce funds.

To make future costs of mental illness studies be more useful, it would be important to follow guidelines and standards of estimating costs of illness. There have been a number of publications in overall estimation methods of cost of illness dating back to the 1960s (Rice, 1966), 1980s (Hodgson and Meiner, 1982), and 1990s (Larson et al., 1996). There are still un-settled issues of how to estimate indirect costs, whether to use discounted life-time earnings or to use costs of replacing production loss (Koopmanschap and Rutten, 1996), and whether to include indirect costs as a part of total cost of illness (Ontario Ministry of Health, 1991; Henry, 1992). It would be best to provide justification of adopting a particular cost estimation method and to report these methods explicitly, so that readers and users of these cost of illness studies are well informed.

Table 1. Distribution of Cost of Mental Illness by Country

	Affective/Anxiety/ Depression	Schizophrenia	Overall Mental Illness	Alzheimer's Disease	Epilepsy
Australia	3		1		
Belgium				1	
Canada		1		1	
China (Taipei)	1	1	1		
France		1			
Hungary		1			
Israel				1	
Italy		2		1	
Kenya			1		
Netherlands		1			
Norway		1			
Spain		1			
United Kingdom	3	2		2	1
United States	4	1	2	2	1
Total	11	12	5	8	2

Table 2. Summary of Cost of Mental Health: Affective/Anxiety Disorder, Depression, Bipolar Disorder

Illness	Country	Year	Direct Costs (US \$ in millions)	Indirect Costs (US\$ in millions)	Total Costs (US \$ in millions)	Direct to Total Cost (%)	Direct Costs/ Total Health Expenditures (%)	Authors & Year of Publication
Affective Disorder	Australia	1997	-	1,400	-	-	-	Lim et al. (2000)
Affective Disorder	Taipei, China	1994	353	1,053	1,406	25%	2.3%	Yeh et al. (1999)
Affective Disorder	USA	1990	19,210	9,858	30,400	63%	2.0%	Rice & Miller (1998)
Anxiety Disorder	USA	1990	11,500	35,100	46,600	25%	1.2%	DuPont et al. (1996)
Anxiety Disorder	USA	1990	10,500	35,440	46,600	23%	1.1%	Rice & Miller (1998)
Depression	Australia	1993/1994	421	-	-	-	1.3%	Andrews et al. (2000)
Depression	(South) Australia	1998	1,362	-	1,986	69%		Sanderson et al. (2003)
Depression	UK	1990	354	-		-	0.5%	Jonsson & Bebbington (1994)
Depression	UK	1990/1991	665	4,783	5,580	12%	0.9%	Kind & Sorensen (1993)
Depression	USA	1990	12,400	31,300	43,700	28%	1.3%	Greenberg et al. (1993)
Bipolar Disorder	UK	1998	332	2,957	3,433	10%	0.4%	Gupta & Guest (2002)

Table 3. Summary of Cost of Mental Health: Schizophrenia

Country	Year	Direct Costs (US \$ in millions)	Indirect Costs (US\$ in millions)	Total Costs (US \$ in millions)	Direct to Total Cost (%)	Direct Costs/ Total Health Expenditures (%)	Authors & Year of Publication
Canada	1996	-	8.2 (HC) 1.2 (FC)	-	-	-	Goeree et al. (1999)
France	1992	2,340	-	5.2	45%	2.0%	Rouillon et al. (1997)
Hungary	1990	41.1	68.5	109.6	37.5%		Rupp et al. (1999)
Italy	1995	8.3	19.5	27.8	30%	.01%	Tarricone et al. (2000)
Italy	1998	-	-	1.2	-	-	Garattinni et al (2001)
Netherlands	1989	432.3	-	-	-	1.6%	Evers & Ament (1995)
Norway	1994	164	.052	-	35.1%	2.0%	Rund & Ruud T (1999)
Spain	1998	1868-2798*	11.2-2161*	-	-	-	Haro et al. (1998)
Taipei, China	1994	120	442	562	21%	0.08%	Yeh et al. (1999)
UK	1990/1991	631	2,710	3,349	19%	0.8%	Davies & Drummond (1994)
UK	1992/1993	1,292	1,200	4,145	31%	1.7%	Knapp (1999)
USA	1990	17,296	11,996	32,500	53%	1.8%	Rice & Miller (1998)

* per patient cost

(HC) refers to Human Capital Approach; (FC) refers to Friction Costs Approach

Table 4. Summary of Cost of Mental Health: Overall Mental Disorders and Other Mental Illness

Illness	Country	Year	Direct Costs (US \$ in millions)	Indirect Costs (US\$ in millions)	Total Costs (US \$ in millions)	Direct to Total Cost (%)	Direct Costs/ Total Health Expenditures (%)	Authors & Year of Publication
Mental Disorders	Australia	1997/1998	567	903	1,470	39%	1.8%	Carr et al. (2003)
Non-Specific	Kenya	1998/1999	.166	.039	.205	8%	-	Kirigia & Sambo (2003)
Mental Disorder	Taipei (China)	1994	473	1,540	1,970	22%	3.2%	Yeh et al. (1999)
Mental Disorders	USA	1990	67,000	74,900	147,800	45.3%	7.0%	Rice & Miller (1998)
Other Mental Health	USA	1990	19,740	17,597	38,400	52%	2.1%	Rice and Miller (1998)

Table 5. Summary of Cost of Alzheimer's Disease (Senile Dementia) Per Patient

Country	Year	Direct Costs (US \$)	Indirect Costs (US\$)	Total Costs (US \$)	Direct to Total Cost (%)	Authors & Year of Publication
Belgium	1999	Home: 6,634 Hospital: 34,272	-	Home: 6,634 Hospital: 34,272	-	Scuvee- Morreau et al. (2002)
Canada	1996	7,124 – 27,734	-	7,124 – 27,734	-	Hux et al. (1998)
Israel	1999	17,000	-	17,000	-	Schnaider et al. (2002)
Italy	1997	52,954	-	52,954	-	Cavallo & Fattore (1997)
UK	1990/91	1.7 billion*	-	1.8 billion*	94%	Gray & Fenn (1993)
UK	1994	11,693 – 24,023	16,447	11,693 – 24,023	-	Souetre et al. (1999)
USA	1990	Community: 12,572 Institution: 42,049	Community: 34,517 Institution: 5,542	Community: 47,083 Institution: 47,581	Community: 27% Institution: 88%	Rice et al. (1993)
USA	1991	47,581	123,556	173,932	30%	Ernst & Hay (1994)

* National estimate

Table 6. Summary of Cost of Epilepsy

Country	Year	Direct Costs (US \$ in millions)	Indirect Costs (US\$ in millions)	Total Costs (US \$ in millions)	Direct to Total Cost (%)	Direct Costs/ Total Health Expenditures (%)	Authors & Year of Publication
UK	1993	1,961	-	1,961	-	2.5%	Jacoby et al. (1998)
USA	1994	1,014	3,210	4,224	24%	.01%	Murray et al. (1996)

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